graphic expression of geologic phenomena—we find that they all belong to the means of intercommunication of geologists. They affect only the verbal and graphic technical language of the science. Of the same nature is the arbitrary time scale whose preparation I favour—a conventional terminology for the facts of correlation. So we may say, in general, that the proper function of the Congress is the establishment of common means of expressing the facts of geology. It should not meddle with the facts themselves. It may regulate the art of the geologist, but it must not attempt to regulate his science. Its proper field of work lies in the determination of questions of technology; it is a trespasser if it undertakes the determination of questions of science. It may decree terms, but it must not decree opinions.

TECHNICAL EDUCATION.[1]

THE present century has witnessed a vast and almost incredible change in the great industries of the world, and in the progress of the arts and manufactures. The causes of this great change are various, though mutually dependent upon each other, such as the cessation of the great wars that had for so long ravaged the continent of Europe, which enabled many of the most vigorous minds to be turned to the arts of peace; the rapid growth of population, which rendered the wants of mankind more pressingly felt; and the more general spread of education, which caused the great discoveries that have enriched this period to be eagerly taken advantage of and adopted.

Among the many results which have ensued, is one which must be carefully studied, affecting as it does in a peculiar degree our own country at this time.

Since the latter half of the last century, when by the disappearance of forests in the iron-producing districts, resulting from the use of timber as fuel, maternal Necessity had brought forth an invention in the shape of the process of smelting iron ore with coal, progress in machinery and manufactures had steadily been made. The great natural advantages arising from the conjunction, not only of coal and iron in the same locality, but also their immediate proximity to the limestone required in iron-smelting operations, had greatly contributed to this advance, until this country, instead of importing four-fifths of the whole iron used from Sweden, as was the case in 1750, had become the greatest iron-producing country of the world. The invention of the steam-engine in conjunction with the power-loom and other important machines, greatly contributed to the growth of the factory system, the establishment of the cotton, linen, and woollen industries, and the rapid increase of manufactories in general. Owing to the insular position of Great Britain, and the prohibitive laws in force, until fifty years ago the nature of the machinery used in all these manufactures, as well as the technical knowledge and skill of the workman, was prevented from being carried abroad. Thus, as stated in the recent Report of the Commissioners on Technical Education:—

"When, less than half a century ago, Continental countries began to construct railways, and to erect modern mills and mechanical workshops, they found themselves face to face with a full-grown industrial organization in this country, which was almost a sealed book to those who could not obtain access to our factories."

This artificial state of things was not destined to last, for, on the one hand, these countries were keenly alive to the importance of possessing such manufactures, and were determined to obtain them at all costs; and, on the other, it was greatly to the immediate advantage of our manufacturers to sell freely in such a market as began to be opened to them. At the same time skilled artisans were easily found who were willing to accompany abroad machinery which had been constructed in this country, and thus to become the means of disseminating technical education of the most practical type amongst those who were quite as industrious and frequently better educated than the workmen at home.

The efforts of foreign nations to establish mills and workshops of their own did not cease here; for, recognizing the necessity of specially spreading technical knowledge by all possible means, technical schools, instituted and supported by the State, at which instruction could be obtained free, or at almost nominal cost, were established in numerous places all over the Continent. The larger number of these schools have been institutions at which the scientific principles underlying industrial and manufacturing operations, rather than the actual operations themselves, were taught, although there are also in lesser number special technical schools, such as the weaving schools of Chemnitz in Saxony, of Crefeld in Rhenish Prussia, of Basle in Switzerland. From these various schools, numbers of highly educated men have been sent out year by year, prepared, when becoming foremen, managers, or employers of labour, to take advantage of the latest discoveries and improvements in various branches of industry, and keenly alive to the fact that "knowledge is power."

Notwithstanding all this, an enormous increase of trade and prosperity was enjoyed by this country for many years, and notably was this the case after the first International Exhibition in Hyde Park, in 1851, which Exhibition revealed to visitors from all parts of the world much (some persons of the old school are to be found, who assert *too* much), concerning the perfection of our machinery and processes of manufacture which had been scarcely realized before, even by ourselves. This prosperity apparently reached a climax from ten to fifteen years ago, and, since then, trade has assumed a very different aspect. At first the change was felt in relation to countries whose resources were in some respects comparable with our own, and afterwards with others less favourably situated, and in place of supplying them with manufactured articles and machinery, they began to enter into competition, and in many cases successful competition, with this country, even in markets hitherto considered all our own. Indeed, a positive reflex action has actually occurred in some important branches of industry and foreign iron, machines, hardware, and textile goods are imported for home use. The result of this competition has been keenly felt, and the consequent struggle which has taken place in these times of peace has been, and now is, almost as determined and often as bitter as in an open war. That rather doubtful compliment once paid by a great general to the British soldier, that he never knew when he was beaten, could scarcely be applied to the British manufacturer, since there is a very speedy way of settling this point in a commercial transaction; but the question upon which knowledge has often been wanting and information sometimes too tardily sought, is rather as to the cause and its remedy. In some cases the cause is obviously due to the lower wages and longer hours for which foreign workmen will toil, and it may be mentioned, as pointing to what may be sometimes possible in this case, that in the neighbouring industry of wire-drawing at Warrington, which was threatened with extinction, the German competition was entirely met and overcome by the wire-workers voluntarily accepting a reduction in wages of 10 per cent., after four of their delegates had visited the Black Forest and ascertained for themselves full particulars as to the wire industry of that district.

But, on the other hand, there are branches of manufacture in which the state of foreign workmen and workwomen is so pitiable that no right-thinking person would desire to have increased trade in this country at such a price to our own people, though happily there is not much fear of this, since the movement is rather in the other direction. But the question of wages is only one of many causes, for it has been asserted by excellent authorities that it is not in those branches of industry in which foreign wages are lowest and hours longest that competition presses most heavily upon us. Thus, according to the recently published Consular Reports, we have still something to learn in several directions in the matter of finding out fresh markets and accommodating our productions to native wants, instead of trying to force goods of our own pattern and design where they are either not in accordance with native views and prejudices, or are unsuitable to the locality. Again, it is not only the Germans who stamp the words "best Sheffield steel" upon cast-iron axes and knife-blades: neither in the matter of shoddy-manufacturers can this country afford to throw stones at our foreign rivals.

It is not, however, the object of this address to enter into a discussion of the various causes of trade depression, and still less to presume to say how such an undesirable state of things may be met and overcome, but to consider a subject which has recently been very vigorously brought forward in connexion with this matter under the title of "Technical Education." No branch of education has of late attracted so much attention as this. It has formed not only the text of the Presidential Address of the British Association in 1885, and part of that at the recent address at Manchester, but of innumerable other speeches, pamphlets, papers, and even books, one of the very earliest and most brilliant of which was a treatise from the pen of the late Mr. Scott Russell. It has been quite recently the subject of a special Government Bill, which was considered sufficiently urgent to be carried through almost to the last stage when other Bills were being dropped right and left, and then disappeared only with the full assurance of a revival in more vigorous form at an early period of next session; while only in last July there was formed "A National Association for the Promotion of Technical Education," which numbers as its President, Vice-Presidents, and Committee, many of the most able politicians, experienced men of business, and well-known men of science.

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[1] Part of Inaugural Address of session of University College delivered at St. George's Hall, Liverpool, on October 1, 1887, by Prof. Hele Shaw, M.Inst.C.E., of the University College, Liverpool.

These facts are quite sufficient to show that there is now a very prevalent and wide-spread belief that the subject of technical education has become one of pressing national importance. There are, indeed, already not wanting persons who connect the subject with the terms "foreign competition" and "commercial depression," by a train of reasoning apparently somewhat as simple as the following:—

1st proposition.—Bad trade is the result of foreign competition.
2nd proposition.—Foreign competition derives its strength from superior foreign technical education.
Conclusion.—Therefore bad trade at home is due to superior technical education abroad.

This mode of reasoning is brief and conclusive enough to satisfy even the most superficial, it is easily portable, and has the advantage of admitting of illustration in certain special cases in which both propositions and conclusion are true, but it is nevertheless a striking example of the danger of arguing from the special to the general. Without, however, accepting such a sweeping generalization, it may be safely said that foreign countries have derived great benefit from their systematic encouraging of technical teaching, and we may proceed to consider briefly what progress we ourselves have made in this direction.

In the first place it may be well to ask what the term "technical education" really means? Most people have, no doubt, a general idea on the subject, but there are a great many who freely discuss the question, who would be woefully at a loss if asked for an exact definition; and if anyone doubts the truth of this, let him try the experiment on a few friends. The answer which will generally be given, with some hesitation, will probably have some not very distinct reference to instruction in the use of tools, backed by allusion to carpentering by way of illustration, or will, perhaps, be some mention of chemistry, or other branch of science, or, as a final resort, "something to meet the German competition." Now the fact is that the first of these may not be really technical instruction at all, but only manual training as part of a general education, as, for instance, is now given out of school hours in the working of wood to the boys at most of our Colleges, partly to keep them out of mischief and partly to train the hand and eye, but in which case there is not the slightest intention or idea that any of the boys shall actually become a carpenter. The last answer, however grotesque it may seem, is much nearer the truth, as it connects technical instruction with a special *object* in view. Now that this is really the idea of those who have thought most carefully over the subject is made clear by the terse and excellent statement of the aims of the Association for the Promotion of Technical Education, one of which is "to effect such reforms in our educational system as will develop in the best way the intelligence of those of all classes upon whom our industries depend," the Association itself being formed because of "the general expression of opinion throughout the country as to the necessity of a reform in our system of national education, with the object of giving it a more practical direction." Thus we may accept the following definition of a writer on the subject, that "by technical education is meant special instruction in some scientific, artistic, or mechanical process or handicraft as distinguished from purely literary instruction"; or that by another writer, who defines it as "special training for an industrial pursuit as distinguished from a general preparation for any calling hereafter to be chosen." Thus technical education will comprise a very wide range of subjects, not those merely taught with a view to manufacturing, mechanical, and artistic pursuits, but will comprise the instruction given in a medical school, in an agricultural college, and even commercial education, which last now forms a distinct feature of our own College, and the reform of which branch of education is one of the special objects of the Association above alluded to. It is therefore at first surprising to the uninitiated that we find the following definition in the recent Bill for Technical Education: "The expression technical instruction means instruction in the branches of science and art with respect to which grants are for the time being made by the Science and Art Department, or in any other subject which may for the time being be sanctioned by the Department." This definition is no doubt quite satisfactory to the authorities of the Department, although it savours strongly of the opinion attributed in a well-known series of rhymes to a certain eminent University don, who is made to assert—

> "I am the Master of this College,
> And what isn't taught here isn't knowledge."

And though this definition happens at present to exclude manual and workshop instruction, concerning which the mover of the Bill, Sir Wm. Hart Dyke, expatiated somewhat eloquently and at considerable length when moving the second reading of the Bill—but this is a trifling matter, as no doubt when the Science and Art Department has had time to go into the matter, and to study the subject, and has made arrangements for teaching and examining it, it will be "sanctioned" with the rest, and become *technical instruction*. It must, however, be recognized that the Science and Art Department is the most important institution in this country for the promotion and encouragement of technical education, and has done a work, especially in the direction of evening-class teaching to the artisan class, which must have proved of incalculable benefit, and it will be well to study the progress made in science instruction, as affording some index of our general progress in technical education. The following table gives the result of work during the last ten years, showing in three columns: (1) the amount of the grants given to teachers for successful candidates on the system of payment by examinational results; (2) the actual number of students under instruction in science classes fulfilling conditions which would enable a grant to be claimed; (3) the number of papers actually worked in different science subjects. The three columns are independent of each other in a certain sense, since a registered student may either take several papers, or may, on the other hand, possibly not come up for examination at all, or, coming up, may fail to secure a grant.

TABLE I.—*Results of Science and Art Department during the last Ten Years.*

Year.	Grants. (1)	Students under Instruction. (2)	Examination Papers actually Worked. (3)
	£		
1878	39,073	59,705	66,365
1879	41,036	56,752	70,248
1880	43,863	60,041	72,428
1881	47,231	61,180	75,735
1882	49,700	67,315	79,786
1883	50,967	71,164	83,387
1884	61,638	77,519	90,825
1885	69,113	81,491	101,275
1886	79,000	97,664	118,241
1887	88,000	103,362	131,896

The results are striking, but in order to reveal their significance more closely, the diagram, Fig. 1, is reproduced from a recent memorandum of expenditure and estimates of the Department, in which the height of the lines in each year from the base line gives the value of grant, number of students, or of worked paper.

The three curves represent at once to the eye the rapid progress which is being made. Indeed, the rate of increase is twice as great during the last two years as during previous years, and, so far from there being any want of appreciation of technical instruction, the results are such as might possibly cause the taxpayer some concern; on this point, however, the memorandum states:—"There is no reason to suppose that the expenditure will rise at the present rate; on the contrary, even without looking at the increased rate of rise of the last few years, as a sudden augmentation due to special causes, it is obvious that as the limit is approached the rate of rise must rapidly diminish. This limit, as far as it can be arrived at by calculation from population, &c., probably about 200,000 persons under instruction in science—there were last session 110,000 under instruction. Continuing the curve for science as it may reasonably be expected to run, we should arrive at about 110,000 in 1896." In any case there is no real cause for alarm, because the standard of work required to secure a grant can always be raised, and, as a matter of fact, appears to be steadily rising year by year, and, after all, the sum of even £101,175, which is the estimated expenditure for the current year in aid of science instruction, is a remarkably small annual expense for the instruction of 103,362 students all over the country.

There has been for several years at work another central agency, which promotes technical instruction in the same manner as the Science and Art Department, viz. by payment upon the results of examination. This body is known as the City and Guilds Institute of London. These examinations carried on by this body were originally established in 1873 by the Society of Arts—the subject that year being cotton manufacture, steel, and carriage building, the number of candidates being respectively one, two, and three, making a grand total of six. The next year, gas manufacture and agriculture were added, and the total rose to thirty-six. Subjects continued to be added, and the numbers to rise year by year, until ten years ago the latter had reached 184, since when the following table shows the progress made, the City and Guilds taking over the whole responsibility of the work in 1881.

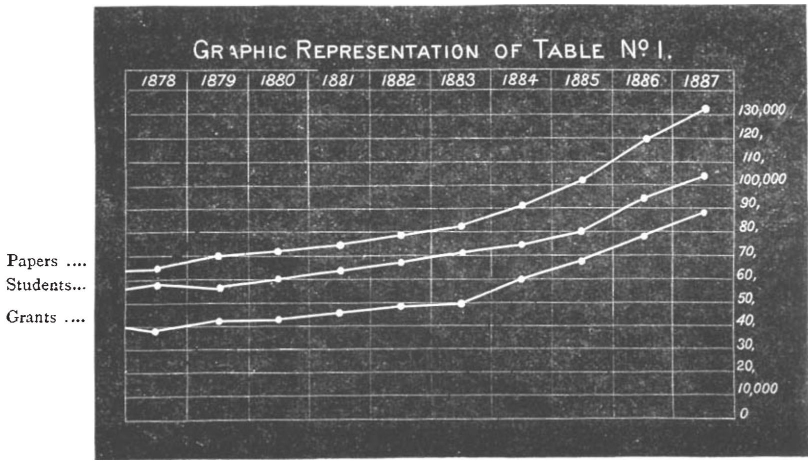

FIG. 1.—Science and Art Department.

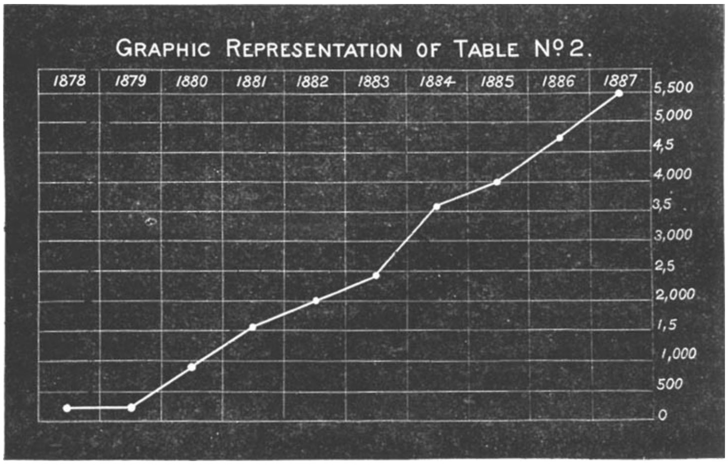

FIG. 2.—City and Guilds of London.

TABLE II.—*Society of Arts and City and Guilds Examinations.*

Years.	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887
Number of Candidates.	184	202	803	1563	1972	2397	3635	3968	4764	5508

I have plotted the above results in a similar manner to those of the Science and Art Department, and it will be seen (Fig. 2) that the rate of growth is far more rapid; and rich as are the worthy livery companies of grocers, fishmongers, tanners, spectacle makers, and others, who form the City and Guilds Institute, they too must have reason to confess that technical education, towards which they have recently contributed not less than a quarter of a million of money, is not quite at a standstill, for at the present rate of growth the number of candidates, large as it now is, will have doubled in the next seven years, though even this, with an assured income of £33,000 a year, may not give them cause for alarm. It may be well to explain that the examinational work of the City and Guilds, and that of the Science and Art Department, not only do not clash, but bear an important and valuable relation to each other. Thus the former is more distinctly technical, dealing with special details of trades and manufactures, and the term "technological examination" is always employed to emphasize this point, and before a full technological certificate is granted by the City and Guilds Institute in any subject, certificates in the elementary stage of certain specified theoretical examinations of the Science and Art Department must be produced. A comparison of a few of the subjects will at once make this clear, the numbers appended to the subjects in the following list being those attached to them in the syllabus of each examining body.

SCIENCE AND ART DEPARTMENT.	CITY AND GUILDS.
Subject II.—Machine Construction and Drawing.	(27) Tools. (*a*) Wood Working. (*b*) Metal Working.
Subject III.—Building Construction.	(34) Carpentry and Joinery. (35) Brickwork and Masonry.
Subject VI.—Theoretical Mechanics. Subject VII.—Applied Mechanics.	(28) Mechanical Engineering.
Subject IX.—Magnetism and Electricity.	(22) Electrical Engineering. (*a*) Telegraphy. (*b*) Electric Lighting. (*c*) Electrical Instrument Making.
Subject X.—Inorganic Chemistry.	(1) Alkali and Allied Branches.
Subject XI.—Organic Chemistry.	(4) Coal Tar Products. (7) Oils, Varnishes. (8) Oils and Fats. (9) Gas Manufacture.
Subject XIX.—Metallurgy.	(10) Iron and Steel Manufacture.

Practical examinations are held by the City and Guilds in weaving and pattern designing, in metal plate work, in carpentry and joinery, and in mine surveying, while last year, for the first time, an examination was held in typography. This latter was conducted in several printing works placed at the disposal of the Institute, and thirty-two out of the seventy-seven candidates succeeded in composing and printing the difficult manuscript supplied to them—sufficiently well to obtain a certificate.

There is nothing at all approaching our own system of payment by results in any country in Europe, and eminent foreign educationalists have frequently deplored the absence of such in their own respective countries. This system has given particular vitality to that most valuable kind of education—evening class instruction; and as an examiner for both the bodies above alluded to, and after an experience—not a very enjoyable experience, and not the experience that a rich man would continue to indulge in—of upwards of 6000 examination papers, I may be permitted to testify to the valuable nature of the work done by the students, and the possibility of almost complete prevention of "cram" when proper precautions are taken. Thus, though large numbers of technical night classes exist all over the Continent, it is very doubtful if the results obtained by them are superior or even equal to our own.

When it is considered what splendid technical training the workshops and manufactories of this country have afforded, there will, perhaps, appear to be very good reasons why, originally, technical schools were not so extensively instituted at home as abroad, where almost all foreign States have established and maintained technical schools, the École Centrale at Paris being almost the solitary exception to this rule. When, however their need was felt, it was not left to the slowly-moving wheels of State to bring such schools on the scene. At first these schools took the form of lectureships and chairs in constructive science, for which the term "engineering" was conveniently adopted, the first of these being at London, Glasgow, and Manchester, and founded in connexion with the local Colleges. These have been gradually followed by Engineering Schools in the Colleges at Leeds, Sheffield, Nottingham, Dundee, Newcastle, Bristol, Birmingham, and last, but it is hoped not least, at Liverpool. These schools give instruction not merely in engineering subjects in a narrow sense of the word, but include in their courses of teaching the wide range of subjects necessary for laying a firm foundation for a successful career in any one of the constructive professions, and prepare a student to enter any of the particular branches into which engineering has become differentiated, and compare in this way with chemical teaching, which is given in places like this city—which may be specialized with a view to particular local industries. Besides these schools, others have arisen of a more special nature, due to liberal-minded men and public-spirited bodies, such as the Weaving and Dyeing Schools at Leeds, upon which the Worshipful Company of Clothworkers have spent between £20,000 and £30,000; the Technical Schools at Huddersfield, Bradford, Glasgow, Manchester, and other towns, some of which will bear comparison with the celebrated foreign schools of Chemnitz, Mulhouse, Verviers, Crefeld, and Vienna. The benefit of such schools has already been felt, for it is most encouraging to find amongst many similar opinions the testimony of the Technical Education Commissioners that—"In those textile manufactures in which other nations have hitherto excelled us, as in soft all-wool goods, we are gaining ground. We saw, at Bradford, merinos manufactured and finished in this country, which would bear comparison in texture and colour with the best of those of the French looms and dye-houses, and in the delicate fabrics of Nottingham and Macclesfield (thanks in great measure to their local Schools of Art) we no longer rely upon France for design."

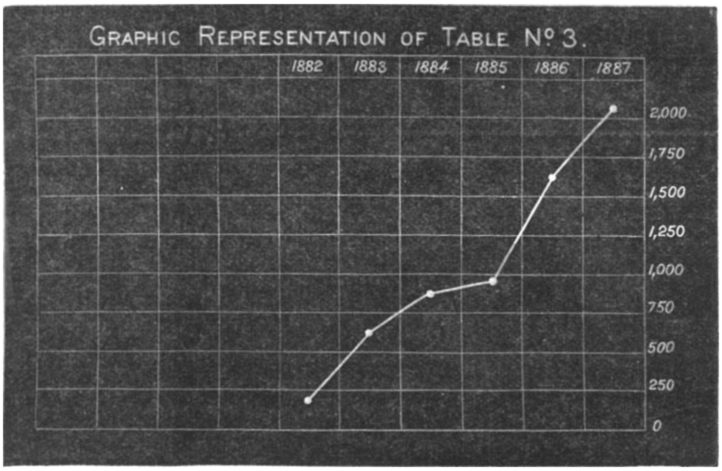

FIG. 3.—University College, Liverpool.

The address, after pointing out that this country was, taken as a whole, after all not in such a deplorable state with regard to technical education, asserted that such education was of two kinds—general and special. General technical education may be said to be that necessary in all large centres of population, being the preparation for such callings as engineering, architecture, medical science, and other professions, which at any rate a certain percentage of the inhabitants will always follow, besides training of another kind suitable to the artisan class. Special technical education is that necessary in a locality where there are special industries, instances of which have already been given, and others will readily occur to the mind.

The remainder of the address was devoted to considering the educational work of Liverpool and its special technical requirements. A brief reference was made to the progress of University College, as shown by the following table of attendances in the day classes since its foundation in 1882.

TABLE III.—*Entries in Day Classes, University College.*

1882.	1883.	1884.	1885	1886.	1887.
189	625	883	944	1642	2063

These results are better shown graphically in Fig. 3.

During the last few months no less than £30,000 has been contributed to the Engineering Department alone, but the other professorships are all provided for upon an equally sound basis, and Prof. Hele Shaw thus concludes:—

"Hence, side by side with teaching, directed—sometimes perhaps only directed—to the practical purposes of life, we shall, thanks to the liberal endowment of chairs of language, of literature, and of art, always have the more liberal studies, and, as their exponents, scholars of the highest culture. Thus every individual professor thinking, as he ought to think, his subject to be the most important of all (a feeling I must, in common with the rest, confess to having myself), and so led to work for its due recognition, the happy mean will doubtless be maintained between mere idealism on the one hand, and mere routine on the other. Yet one word more. There is another motto prominent upon the College crest ('*Fiat lux*'), in the spirit of which work will always be true to the highest ideal. Our national life depends upon our national progress, and when we cease to advance, decay will speedily follow. Just as surely our College life, vigorous because growing, depends for its vitality upon the reality of the effort we make to carry forward the light of truth, and should never suffer because we strive to keep in touch with the requirements of practical life. Scientific investigation and philosophic research must have their proper place and support, and if allowed fair scope for development, will exercise the needful influence, and one that will be of untold value upon such narrowing tendencies as there may be in our various schemes of technical education."

SCIENTIFIC SERIALS.

American Journal of Science, October.—The relations between wind velocity and pressure, by H. Allen Hazen. A comparative study is made of the experiments carried out by Borda, Hagen, Piobert, Didion, Morin, and more recently at Washington, showing the great necessity there is for further research before absolutely trustworthy results can be obtained. Experiments are much needed, especially with larger plates than 2 feet square, with bodies of other forms than those hitherto employed and with high velocities by a straight-line motion.—Is there a Huronian Group? (continued), by R. D. Irving. After establishing the existence of a true Huronian Group, the author proceeds to define its character, showing that many formations even in the Lakes Superior and Huron regions, have been wrongly referred to this type. The presence is clearly demonstrated of two entirely distinct and mutually discordant series in the Marquette, Penokee, and Menominee districts. In all these regions there are great discordances between a lower set of gneisses and other crystalline schists, intruded by granite, and an upper set of detrital rocks carrying iron. The so-called Animikė series is then considered, and referred with the older Penokee formations to the Huronian system.—Oxygen in the sun; contributions from the Physical Laboratory of Harvard University, by John Trowbridge and C. C. Hutchins. The experiments here described have been carried out in order to test the soundness of the conclusion generally drawn from Dr. Henry Draper's discovery of bright spaces in the solar spectrum apparently coincident with the bright lines of the spectrum of oxygen. This conclusion is shown to be at least premature, and in the numerous photographs taken of the solar spectrum by them the authors have failed to discover any line that could with certainty be pronounced brighter than its neighbours. The bright bands of Dr. H. Draper's spectrum are found to be occupied by numerous dark lines of various degrees of intensity; but the hypothesis of Prof. J. C. Draper that these are the true representatives of the oxygen lines is rendered untenable by the lack of any systematic connection between the two.—Bismutosphærite from Willimantic and Portland, Connecticut, by H. L. Wells. An analysis of two specimens of basic bismuth carbonate shows them to be apparently identical with Weisbach's bismutosphærite, the composition of which had been considered somewhat doubtful.—Note on some remarkable crystals of pyroxene from Orange County, New York, by George H. Williams. The lower back part of some of these specimens is exactly like the lower front quarter, but in a reversed position, so that the lower half is a twin as represented by Von Rath, while the upper half is apparently simple and of the usual habit.—The flow of solids, or liquefaction by pressure, by William Hallock. The experiments here described point at the conclusion that pressure alone cannot truly liquefy a solid—that is, diminish its rigidity; consequently neither can chemical or mineralogical changes be produced by pressure alone without a rise of temperature.—Analysis of some natural borates and borosilicates, by J. Edward Whitfield. The series of analyses here described have been undertaken to verify, if possible, the given formulæ, and correct errors caused by defective analytical methods of estimating the boric acid of natural borates. The percentages of boric acid as here determined by direct analysis do not differ greatly from the results of Stromeyer's and Marignac's methods.—The Texas section of the American Cretaceous, by Robert T. Hill. In this paper the author studies the true character of the deep marine Cretaceous strata already determined by him in Texas, at the same time explaining some new features of it, which throw much light on the various American chalk systems.—Notice of new fossil mammals, by O. C. Marsh. Descriptions are given of some new species of *Bison alticornis*, *Aceratherium acutum*, *Brontops robustus*, *Menops varians*, *Titanops elatus*, and *Allops serotinus*, recently received at the Yale Museum from the West.

Rivista Scientifico-Industriale, September 15.—On the pressure of mixtures of gases and vapours, and on Dalton's law, by Prof. G. Guglielmo and V. Musina. Regnault, while admitting that Dalton's law on the tensions of vapours in gases is not strictly verified, and that the maximum tensions are less in gases than in vacuum, concluded that the law was theoretically exact, and would even be verified in practice in a receptacle whose walls were formed of the liquid generating the vapour. The experiments here described have been carried out for the purpose of testing the accuracy of this view, with the result that the attraction of the walls for the vapour is far from sufficing to explain the discrepancies of the Daltonian law. Consequently this law is not even theoretically correct, at least so far as can be concluded from these researches, which, however, will require to be repeated with apparatus insuring greater precision than those here employed.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, October 31.—M. Janssen in the chair.—Observations of the minor planets made with the great meridian of the Paris Observatory during the second quarter of the year 1887, by M. Mouchez. The right ascension and Polar distance, with correction of the ephemerides, are given for Belisane, Athor, Asterope, Nausicaa, Vesta, Antiope, Amphitrite, Polana, Bellona, Hecuba, and Arethusa.—On the Observatory of Nice, by M. Faye. In connection with the Geodetic Conference just concluded at Nice, the author announced that the magnificent Observatory of that place, due to the munificence of M. Bischoffsheim, is now completely finished. This institution, he added, is entirely at the service of the astronomers of all nations who may wish to avail themselves of its exceptional advantages in the prosecution of their researches.—New fluorescences with well-defined spectral rays, by M. Lecoq de Boisbaudran. The results are described of spectral researches made with gallina and samarine ($Ga_2O_3 + \frac{1}{50} Sm_2O_3$) moderately calcined; the same very highly calcined; gallina and the earth $Z\alpha_2O_3$; gallina and the earth $Z\beta_2O_3$; and alumina with a small portion of the oxide of praseodyme (Pr_2O_3) highly calcined.—Observations of the new planet, Peters (270), made at the Observatory of Algiers with the 0·50m. telescope, by MM. Rambaud and Sy. The observations cover the period from October 14 to October 17.—Observations of the new planet, Knorre (271), made at the same Observatory by the same astronomers during the period from October 20 to October 24.—Magnetic declinations and inclinations observed in Tunis by the Hydrographic Mission of 1884-86, communicated by M. Bouquet de la Grye. The results of these observations are tabulated for twenty-one places, whose latitudes and longitudes are also accurately determined.—On the